APPENDIX 7

HIGH ARCTIC ENVIRONMENTAL SCREENING REPORT

ENVIRONMENTAL SCREENING REPORT

IMPACTS OF IMPLEMENTING THE REMEDIATION AND RISK MANAGMENT PLAN

AT

SIX HIGH ARCTIC OIL AND GAS SITES IN NUNAVUT:

ROMULUS, LOUGHEED ISLAND, DALE PAYNE, REA POINT, DRAKE POINT, and THOR ISLAND

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EXECUTIVE SUMMARY

Six contaminated sites, known as Romulus, Lougheed Island (L1), Dale Payne, Rea Point, Drake Point, and Thor Island, are located on the High Arctic islands of Nunavut, Canada. The sites are under the care of Indigenous and Northern Affairs Canada (INAC) as part of the Federal Contaminated Sites Program (CSP). The sites are former oil and gas exploration operations, in some cases originating from activities that took place more than fifty years ago. Metal and petroleum hydrocarbon (PHC) contamination at the sites is generally a result of oil and gas exploration activities (Blumetric Environmental Inc. 2016).

INAC projects in Nunavut are subject to the territorial environmental impact assessment (EIA) process under Section 12.4.2 of the Nunavut Land Claims Agreement (NLCA). The objective of this environmental screening assessment is to assess the environmental, social, economic and cultural effects of the proposed remediation and risk management of the sites, including identification of potential impacts and development of mitigation measures where necessary.

The recommended remediation and risk management plan, in summary, is to leave most aspects of the sites in their current state. Warning signage will be posted at all sites and hazardous materials will be removed from the interior of the buildings at Dale Payne. This recommended plan is based on the findings of detailed site assessments and the outcome of human health and ecological risk assessments for each of the sites.

Land use will be monitored through the following approaches:

- Annual interviews with hamlet staff in Resolute Bay including the Senior Administrative Officer and development officer;
- Annual review of Land use permit, mineral claims and land and water board activity in the area;
- Periodic site inspections for signs of activity.

If there are significant changes to land use in the site areas, then the Human Health and Environmental Risk Assessments will be revisited.

This Environmental Screening Report for the proposed remediation and risk management plan for the sites includes the following:

- Site Description
- Project/Environment Interactions
- Aquatics/Hydrological Resources
- Cultural Features
- Socio-economic Impacts
- Mitigating Measures
- Residual Impacts
- Cumulative Environmental Effects
- Knowledge Deficiencies

There will be negligible impacts on wildlife, vegetation, aquatics, hydrology, cultural features, socio-economic variables, or cumulative effects. There may be a small positive socio-economic effect if Nunavut residents are hired for labour.

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1 INTRODUCTION

This is the required environmental screening assessment for remediation and risk management of the six contaminated sites located on the High Arctic islands of Nunavut, Canada. The sites are known as Romulus, Lougheed Island L1, Dale Payne, Rea Point, Drake Point, and Thor Island. The general objective of the environmental screening assessment is to assess the environmental, social, economic and cultural effects of the proposed remediation and risk management of the former exploration sites, including identification of potential impacts and development of mitigation measures where necessary. Specific objectives required to achieve the general objective include:

- Identify project components and development activities which may result in potential impacts to the environment and the effect of these on the receiving physical and/or socio-economic environments.
- Identify existing conditions within the project area, including existing uses of land, resources and other activities which have the potential, in combination with proposed remediation activities, to affect the physical and/or socio-economic environment.
- Assess cumulative effects associated with this project and other past, present or proposed projects in the area.
- Determine any follow-up requirements.

The sites are under the care of Indigenous and Northern Affairs Canada (INAC) as part of the Federal Contaminated Sites Program (CSP). The sites are former oil and gas exploration operations, in some cases originating from activities that took place more than fifty years ago. Metal and petroleum hydrocarbon (PHC) contamination at the sites is generally a result of oil and gas exploration activities (Blumetric Environmental Inc. 2016).

INAC projects in Nunavut are subject to the territorial environmental impact assessment (EIA) process. Nunavut EIA requirements are specified in Section 12.4.2 of the Nunavut Land Claims Agreement (NLCA), which requires that the Nunavut Impact Review Board (NIRB) screen project proposals. Project proposals are provided to NIRB by regulatory agencies as part of the overall project approval process. The objective of this environmental screening assessment is to assess the environmental, social, economic and cultural effects of the proposed remediation and risk management of the sites, including identification of potential impacts and development of mitigation measures where necessary.

Identification of potential receptors (plants, animals, etc.) of contaminants, and assessment of potential impacts of contaminants on the receptors, was completed for all six of the contaminated sites by Guppy (2015; **Appendix 1**). A *Heritage Resource Overview Assessment* of the six project sites was completed by Bennett and Mooney (2016; **Appendix 2**). Those reports, as well as the *Remediation and Risk Management Plan* by Blumetric Environmental Inc. (2016), should be consulted for more details regarding the sites.

Blumetric Environmental Inc. has retained Ecofor Consulting BC Ltd (Ecofor) to provide an Environmental Screening Report for the proposed remediation and risk management plan for the sites, including the following:

- Site Description
- Project/Environment Interactions
- Aquatics/Hydrological Resources
- Geology, Hydrology, Climate
- Cultural Features
- Socio-economic Impacts
- Mitigating Measures
- Residual Impacts
- Cumulative Environmental Effects
- Knowledge Deficiencies

This report addresses Section 12.5.2 of the *Nunavut Land Claims Agreement* (NLCA)[1].

2 REMEDIATION AND RISK MANAGEMENT PLAN

BluMetric (formerly WESA) completed Phase I/II Environmental Site Assessments (ESAs) for all sites in 2012 and Phase III ESAs in 2015. The data from these assessments were incorporated into Human Health and Ecological Risk Assessments (HHERA) for each of the six sites, which were completed by BluMetric in 2016. The results of the HHERAs form the basis of the *Remediation and Risk Management Plan* (RRMP) for the sites. The details of the plan are provided in the *Remediation and Risk Management Plan for Six High Arctic Oil and Gas Sites: Romulus, Lougheed Island (L1), Dale Payne, Rea Point, Drake Point, and Thor Island, Nunavut (2016)*.

In summary, the recommended remediation and risk management plan consists of leaving most aspects of the sites in their current state. The sites will be visited in the summer to post warning signage at all sites; installation of signs should be completed in a 14-day program with access by helicopter or Twin Otter as appropriate. The abatement and removal of asbestos and other hazardous materials at Dale Payne will likely require an additional 7-14 days, with access by Twin Otter; the waste will be disposed of in the south. See the RRMP for further details.

Based on the outcomes of detailed human health and ecological risk assessments for each site, it is recommended that site impacts remain in place with regional activities being monitored to assess potential changes in site use that may result in increased exposure to contaminants of concern. Land use will be monitored through the following approaches:

- Annual interviews with hamlet staff in Resolute Bay including Senior Administrative Officer and development officer
- Annual review of Land use permit, mineral claims and land and water board activity in the area.
- Periodic site inspections for signs of activity

[1] http://nlca.tunngavik.com/?page_id=1218#ANCHOR1290.

3 SITE DESCRIPTIONS

The *Area of Environmental Concern* (AEC) was referred to in previous reports as the *Area of Potential Environmental Concern* (APEC). The approximate locations and the total affected area at each site, as given in the RRMP, are:

SITE	LATITUDE	LONGITUDE	AEC TOTAL AREA (M^2)
Rea Point	75.3609885	- 105.727430	5,350
Drake Point	76.4128351	- 108.485761	36,094
Lougheed L1	77.3495300	- 105.306970	1,294
Dale Payne	77.4366990	- 105.444878	890
Thor Island	78.1236777	- 103.177714	3034
Romulus	79.8526215	- 84.3763794	2,604
		TOTAL AREA	**49,266**

3.1 REA POINT

Rea Point is near the southeast coast of Melville Island, about 318 km west-northwest of the nearest community, Resolute Bay, Nunavut. Rea Point served as a base camp for Panarctic's operations throughout the arctic. All historical buildings, drums and major debris have been buried or removed from the AECs. There is currently a minimal amount of metal and wood debris scattered throughout the AECs. Some building footprints, roadways and trails are visible, and the site's airstrip was in good condition during the time of the Phase II and III ESAs (AANDC 2015).

The Rea Point AECs are sandy and sparsely vegetated with mosses, lichens, grass clumps and scattered other vascular plants. Some AECs are filled with rock mixed with sand. There are shallow surface run-off channels with sandy substrate, which were dry at the time of field assessment. The surrounding landscape varies from thinly vegetated to fully vegetated. Wildlife using the area include polar bear, muskox, wolf, caribou, gulls, terns and other birds. PHC odours were present at some of the AECs. AEC 5 is at the top of a steep slope down to a river that appears suitable as Arctic char rearing and spawning habitat; however, no contamination is present in AEC 5.

3.2 DRAKE POINT

Drake Point is near the northeast coast of Melville Island, about 420 km northwest of the nearest community, Resolute Bay, Nunavut. All historical buildings, drums and major debris have now been buried or removed from the AECs. Some building footprints, roadways, and trails were visible during the time of the Phase II ESA (AANDC 2015).

The Drake Point AECs are sandy/silty and sparsely vegetated with mosses, lichens, grass clumps and scattered other vascular plants. The surrounding landscape varies from thinly vegetated to fully vegetated. Wolf, lemming, muskox, snowshoe hare, fox, and birds use the area. AECs are barren, with very sparse vegetation, and PHC odours are present at some AECs. Multiple sumps are present, which show evidence of contamination and with mosquito larvae. The contaminants may be taken up by the mosquito larvae, and then transferred to birds that eat the mosquito larvae. There are two streams east and west of AEC 9.

3.3 LOUGHEED ISLAND

Lougheed Island is about 430 km northwest of the nearest community, Resolute Bay, Nunavut. Lougheed Island (L1) is a former Panarctic site, which acted as a secondary staging point for operations on Lougheed Island as well as being a well site for Panarctic's oil and gas exploration program. The main site consists of an airstrip, a fuel and material storage area, and a suspected camp. Within these areas are two drum caches, burn pits, scattered metal and wood debris (AANDC 2015).

The Lougheed Island AECs are barren, sandy/silty and sparsely vegetated with mosses, lichens, grass clumps and scattered other vascular plants. The surrounding landscape varies from thinly vegetated to fully vegetated. Wolf, lemming, caribou, muskox, and snowshoe hare use the AECs. PHC odours were present at some of the AECs. There was one small pond about 5 x 5 m in size, and a large lake about 400 m to the northwest of the AECs.

3.4 DALE PAYNE

Dale Payne is located on the west side of Lougheed Island, about 410 km northwest of the nearest community, Resolute Bay, Nunavut. The Dale Payne study site represents the remains of a former Dale Payne and Associates oil exploration site. Equipment and structures were moved to their current location from another site on Lougheed Island for storage. The site currently consists of sleigh mounted structures, sleigh mounted fuel tanks, two small track mounted machines, scattered drums and scattered debris (AANDC 2015).

The Dale Payne AEC is barren, sandy/silty and sparsely vegetated with mosses (especially), lichens, grass clumps and scattered other vascular plants. Surface drainages are absent, with no surface water present. The surrounding landscape varies from thinly vegetated to fully vegetated. Wolves were seen at the AEC.

3.5 THOR ISLAND

Thor Island is located about 440 km northwest of the nearest community, Resolute Bay, Nunavut. The Thor Island site is a former Panarctic site (Panarctic Oils/Thor H-28 Well) which currently consists of three airstrips, two well markers, two suspected well sumps, a burn pit, disturbed ground, trails, and a minor amount of debris (AANDC 2015).

The Thor Island AECs are sandy/silty and very sparsely vegetated with mosses, lichens, grass clumps and scattered other vascular plants. The surrounding landscape varies from thinly vegetated to fully

vegetated, with shallow, dry surface channels. Caribou, polar bear, fox, gulls, and lemmings use the AECs; seals are in the nearby ocean. PHC odours were present, with PHC plumes visible. Two sumps with water are present, with PHC contaminants apparent.

3.6 ROMULUS

Romulus is located on the west side of Ellesmere Island, about 400 km north of the nearest community, Grise Fiord, Nunavut. Romulus is a former Panarctic site and was an exploratory well site during Panarctic's operations in the Arctic. Historical buildings and most major debris have been removed from the site. There is currently a moderate amount of metal, wood, rubber, and plastic debris scattered throughout the site. The well head, trails and areas of disturbed ground that are suspected to be the locations of historic sumps, drill rig infrastructure and a camp area are present at the site (AANDC 2015).

The Romulus AECs are barren, sandy/silty and very sparsely vegetated with mosses, lichens, grass clumps and scattered other vascular plants. Willow (*Salix arctica*) and cottongrass (*Eriophorum* species) are present. The surrounding landscape varies from thinly vegetated to fully vegetated. Two ponds were present with shorebirds (red knots) feeding in pond sediments. Muskox, snowshoe hare, fox, ermine, raptors, shorebirds and wolves use the area. PHC odours were present.

4 PROJECT/ENVIRONMENT INTERACTIONS

4.1 WILDLIFE

There will be negligible impacts on wildlife, vegetation, aquatics, hydrology, cultural features, socio-economic variables, or cumulative effects. Time-limited disturbance impacts to wildlife will occur from the chosen remediation and risk management option, with about 7 days of disturbance during the placement of signs and up to 21 days of disturbance during the removal of hazardous materials from Dale Payne. Therefore, there will be minimal negative effects on wildlife through any mechanism:

- habitat change – there will be no wildlife habitat change, except for the presence of human activities during the works (primarily due to the effects of noise),
- corridor impairment – there are no known wildlife corridors; however, if any are present they will not be affected,
- habitat fragmentation – no barriers to wildlife movement or habitat use will occur,
- habitat disruption (individually and socially) – the presence of human activities during the works will result in time-limited individual disruption primarily due to noise,
- change in species composition and distribution – no change in populations or their distributions will occur,
- terrestrial species at risk – no terrestrial species at risk will be affected beyond the presence of human activities during the works resulting in time-limited individual disruption primarily due to noise, and

- terrestrial special resource species – no terrestrial special resource species will be affected beyond the presence of human activities during the works resulting in time-limited individual disruption primarily due to noise.

All other aspects of wildlife and wildlife habitat will also have minimal to no impacts, whether positive or negative, from the remediation and risk management option. There will be no monitoring program for wildlife, because no impacts to wildlife are anticipated beyond the immediate, time-limited impacts of disturbance during the works.

4.2 VEGETATION

Vegetation will not be removed or altered at the AECs by the chosen remediation and risk management option. The placing of signs will not affect vegetation (except at some AECs for the exact footprint of the signs); neither will the removal of hazardous materials from Dale Payne. Therefore, there will be no effects on any aspects of the AECs such as:

- overall vegetation communities – there will be no change in the overall vegetation communities,
- soil stability – soil stability will not be affected,
- adjacent aquatic resources – adjacent aquatic resources will not be affected,
- wildlife species – the quality, quantity and availability of vegetation to wildlife species will not be affected,
- species at risk – plant species will not be affected, and
- special resource species – special resource plant species will not be affected.

All other aspects of the vegetation communities will also remain unchanged, either positively or negatively, in the short-term. In the long term (decades) revegetation of barren areas may occur. There will be no monitoring program, because negligible impacts to vegetation are anticipated from the remediation and risk management option.

4.3 AQUATICS/HYDROLOGICAL RESOURCES

Aquatic and hydrological resources, including fish habitat, will not be impacted by the chosen remediation and risk management option. The placing of signs will not affect either resource; neither will the removal of hazardous materials from Dale Payne. Therefore, there will be no effects on any aspects of the AECs such as:

- surface hydrology – surface hydrology will not be affected by sign placement,
- ground water hydrology (frozen) – permafrost will not be affected by sign placement, nor will the water in the unfrozen surface layer that is unfrozen in the summer,
- fish or fish habitat – fish and/or fish habitat will not be affected,
- water quality – water quality will not be affected,
- inputs of sediment or other deleterious substances – there will be no inputs of deleterious substances,
- habitat alterations or destruction – there will be no aquatic habitat alterations or destruction,

- aquatic species at risk – there will be no aquatic species at risk affected, or
- aquatic special resource species – there will be no aquatic special resource species affected.

All other aspects of aquatic resources and hydrology will also remain unchanged, either positively or negatively, by the remediation and risk management option. There will be no monitoring program, because no impacts to aquatic resources and hydrology are anticipated from the remediation and risk management option.

4.4 LANDFORMS

Thor, Rea Point, Romulus, and most of Drake Point are flat and gently sloping to the ocean. Drake Point AEC 1 and 4 are on the flat upper edge of a steep ridge, and AEC 3 flat has shallow stream beds. Lougheed L1 and Dale Payne are also flat with shallow stream beds.

4.5 GEOLOGY

All the sites are in the Innutplan Orogen Geological Province. The bedrock is sedimentary at all sites, with the geological age of the bedrock at Rea Point being Palaeozoic-Devonian; Drake Point and Thor Island being Mezozoic-Lower Cretaceous; and Dale Payne, Lougheed L1, and Romulus being Cenozoic-Tertiary. All the sites are in areas that were not glaciated during the Wisconsinian period. As a result, the soils are primarily colluvial sands and gravel, with till at Romulus (Natural Resources Canada 2009). The soils are sands, clay, and some silts making the areas susceptible to water and wind erosion. However, the underlying permafrost and low relief to the topography limits the potential for erosion.

4.6 HYDROGEOLOGY

The hydrogeology (underground water or 'groundwater') characteristics are primarily determined by the sites all being located in the zone of continuous permafrost (90-100%) (Natural Resources Canada 1995). Permafrost at the bottom of the active surface layer will act as a barrier below the groundwater table, and the movement of groundwater and infiltrating surface water can be expected to follow the local contours of the permafrost (and/or bedrock in areas of shallow overburden) toward low-lying areas.

4.7 HYDROLOGY

Surface hydrology is primarily determined by local precipitation (Section 4.8), local landforms (Section 4.4), and soil characteristics (Section 4.5). Surface run-off in the summer has eroded very shallow stream channels at some of the sites (Section 3). Greater depth of stream channels is prevented by the presence of permafrost and low annual rainfall.

4.8 CLIMATE

The climate of the Canadian Arctic Islands is summarized by Maxwell (1981), with delineation and description of climatic regions and subregions. Rea Point is in Region I (Northwestern), on the boundary

between Subregions Ia (Western Parry Channel) and Ic (Bathurst-Prince of Wales Islands). Dale Payne, Lougheed L1 and Thor Island are in Region I (Northwestern) Subregion Ia. Romulus is in Region V (Northern) Subregion c (Axel Heiberg and Ellesmere Highlands).

Sub-region Ia - Western Parry Channel: Climatic conditions are slightly modified Arctic Ocean climatic conditions. The land weather is determined by that of the numerous channels surrounding the many small islands; the channels are dominated by multi-year sea ice both in summer and winter. The annual net radiation over the land is higher than over the Arctic Ocean, and the persistent sea-ice cover reduces the maritime effect such that the mean annual temperature range is still very high. Surface-based temperature inversions are very prevalent in winter months, and blizzard conditions can be common. The mean January temperature is -35°C; the mean July temperature is 3°C. The mean annual temperature range is 38-40°C. Annual precipitation is around 100-125 mm, with 35-40% falling as rain.

Sub-region Ic: Bathurst - Prince of Wales Islands: Climatic conditions are similar to the Western Parry Channel sub-region. Sea-ice conditions here are a mixture of multi-year and first-year types with the degree of summer clearing variable from year to year. Blizzard conditions can be common. The mean January temperature is -35°C; the mean July temperature is 3°C. The mean annual temperature range is 38-40°C. Annual precipitation is around 100 mm, with 30-35% falling as rain.

Sub-region Vc: Axel Heiberg and Ellesmere Islands Highlands: The climate is somewhat similar to the mountainous sub-region of Baffin Island, because both are dominated by mountainous terrain with extensive glacierization. The mean January temperature is -28 to -32°C; the mean July temperature is 0 to 3°C. The mean annual temperature range is 35°C. Annual precipitation is around 200 mm, with 20-30% falling as rain.

4.9 CULTURAL FEATURES

A Heritage Resource Overview Assessment of the six project sites was completed by Bennett and Mooney (2016; **Appendix 2**). No previously recorded archaeological sites or cultural heritage features were known to be within a 1 km radius of the six project center points. The potential for impacts to previously unrecorded heritage resources was assessed at each of the six locations. Resource types potentially present that were included in the assessments consisted of: historic sites; permanent (seasonally reused) habitation sites (long term use campsites); temporary habitation or subsistence sites (temporary campsites); caches; human remains (isolated remains and burials); fishing sites; hunting sites; gathering sites; quarry sites; stone alignments; cairns; trails and palaeontological resources. Key landforms most likely to have been used for these activities vary greatly but may include ridges, points, sheltered bays, deltas, historic portages, and raised beaches. The results of the Heritage Resources Overview Assessment (HROA) indicate that there is potential for archaeological and heritage resources to be present within each of the six sites. However, the probability of the presence of heritage resources is greatest at Romulus, followed in descending order by Rea Point, Drake Point, Thor Island, Dale Payne and Lougheed Island (L1).

Romulus has a significant amount of exposed rock and the greatest potential for palaeonotological remains, as well as isolated coal and amber finds. Of particular interest is one image from the summer of 2015 with what appears as a slight depression in a cottongrass covered landform (see **Appendix 2**, Figure

11). It is uncertain if this is a common feature of the landform, if it was a historic oil and gas exploration disturbance, or if it stands out as a unique change of vegetation and ground surface. Similar depressions have been the result of cultural activities and may reflect use as a cache, storage pit, or perhaps a habitation site. If this landscape feature was not the result of recent oil and gas impacts, then it has a moderate to high potential to contain heritage resources. Sign placement at Romulus is recommended to avoid depression areas and use caution for the presence of paleontological remains.

Photographs from Drake Point revealed that some areas included a large amount of thin lithic materials that may include chipped lithic debitage (see **Appendix 2**, Figure 9). It is uncertain if any of these lithic fragments may be the result of stone tool manufacturing, but sign placement should avoid areas of potential chipped lithics.

One possible heritage resource was identified at Thor Island in which a series of flat angular rock was photographed at AEC 3 (see **Appendix 2**, Figure 10). This area should be avoided by sign placement and future ground disturbance; however, this AEC was heavily worked by heavy machinery at the time of drilling and exploration, and future on-the-ground assessment may indicate avoidance is not required for most of the area. This rock scatter may be cultural and could be a rock pavement or other stone feature which represents a temporary habitation site, disturbed cache, disturbed navigational marker, or other type of heritage site.

The placing of signs will not affect any known cultural heritage resources; neither will the removal of hazardous materials from Dale Payne. Therefore, there will be no negative effects on heritage resources.

The placing of signs and removal of materials from Dale Payne would not have any negative impact on traditional users relative to hunting and trapping in the proposed AEC areas. The signs may draw the attention of birds and mammals for possible perches and scratching posts or scent marking features. The signs would also likely draw the attention of hunters and trappers in the area, and may serve multiple purposes as warning signs, way markers and visual scale references etc.

The removal of materials from Dale Payne would not have any negative impacts to the current aesthetic features (long or short term) to visitors to the site. The placing of signs may have a negative short and long term impact to the visual aesthetic features of the sites; however, lack of visitors to the areas will largely prevent this. If the signs are greatly impacted by the weather conditions and begin to break apart then fragments may be scattered, which could further reduce the visual aesthetics. High quality signs with long-term design life will mitigate the potential for break-up, and they will be well installed to ensure they remain in place. The placement of signs may also draw birds or mammals which may be viewed as a positive impact to aesthetics, but if the birds and mammals are drawn into greater contact with the contaminants, then they may also have a negative impact. This is unlikely to be significant.

4.10 Socio-economic Impacts

The placing of signs and removal of materials from Dale Payne would not have any anticipated negative impact on the socio-economic well being of the traditional users in these six areas. The hiring of local participants and use of northern businesses and service providers while installing the signs and removing materials from Dale Payne would have a small but positive economic effect on nearby communities.

Negative interaction with contaminants while removing materials and/or setting signs is unlikely, because proper personal protective equipment and materials handling procedures and protocols will be used to negate those effects.

4.11 Mitigating Measures

Most potential impacts resulting from the remediation and risk management project have been avoided through the choice of the lowest impact remediation and risk management option, as discussed in the RRMP. Installation of signs will have short-term wildlife disturbance impacts, with the impacts minimized by the choice of hand-installation methods. The use of high quality signs with long-term design life will mitigate the potential for break-up, and they will be well installed to ensure they remain in place. Removal of the hazardous materials from Dale Payne will inevitably have a longer period of wildlife disturbance, but the disturbance will be very localized and time-limited.

4.12 Residual Impacts

Environmental changes (residual impacts) of the chosen remediation and risk management option will generally be minimal in the near term, and potentially positive in the longer term. Removal of the hazardous materials from Dale Payne will be a positive improvement in both the short and long term. The natural degredation of the petroleum products will likely be a long, slow process, given the 30 – 50 years the material has already been present, but is anticipated to eventually yield a positive benefit. The metals contamination can be expected to remain indefinitely.

5 Cumulative Environmental Effects

The area considered for cumulative environmental effects is the High Arctic islands on which the sites are situated. The cumulative effects of the proposed Project, including ancillary activities, will be negligable because there will be minimal change or other disturbance to the sites from the chosen remediation and risk management option.

5.1 Past and Existing Stressors

- human land use – has low significance, because human use of the areas is currently near Nil. Past land use was primarily oil and gas exploration.
- heritage resource disturbance – has negligible significance, because disturbance to the ground surface and heritage resources on or in the ground were likely low in the past, and are currently negligible.
- resource consumption – has negligible significance, because resource consumption is currently limited to the existing impacts of the contamination on the AECs. Past resource consumption (destruction of vegetation, and likely some hunting) occurred during the oil and gas exploration period. Prior to oil and gas exploration, resource consumption of vegetation and wildlife by the Inuit people likely occurred at all the AECs.

- wildlife disturbance – has negligible significance, because disturbance of wildlife is currently negligible. In the past, wildlife disturbance was likely locally high during the oil and gas exploration period.
- pollutants – has negligible significance in relation to this project; however, pollutants from more southern areas are known to be deposited in Arctic environments (Hung et al 2016). The oil and gas exploration period deposited a variety of pollutants, including metals, petroleum products, and other materials.
- climate change – has negligible significance in relation to this project; however, climate change is known to be affecting the High Arctic, resulting in changes in temperature and precipitation patterns, and high, low, and average values (IPCC 2007). Most, and perhaps all, of these changes became noticeable after the oil and gas exploration period at the AECs.

5.2 Contribution of Project to Existing Stressors

- human land use – the project has Nil contribution to the stressor, because human use of the areas will remain near Nil other than the relatively brief period required for the remediation activities.
- heritage resource disturbance – the project has Negligible contribution to the stressor, because disturbance to the ground surface and heritage resources on or in the ground are expected to be nil to negligible. Signage crews may also identify and record additional heritage resources.
- resource consumption – the project has Nil contribution to the stressor, because resource consumption will remain near Nil.
- wildlife disturbance – the project has Negligible contribution to the stressor, because disturbance of wildlife will remain near Nil, except for the actual period of remediation activities. Wildlife will likely move away from the AECs during remediation activities, and return afterward.
- pollutants – the project has Negligible contribution to the stressor, although the contaminants left on the AECs will result in locally high levels of pollutants such as petroleum products and metals. Contaminant level will not change, or will decrease (Dale Payne).
- climate change – the project has Negligible contribution to the stressor, although some greenhouse gas emissions will occur as a result of the use of aircraft and machinery during the remediation activities. The natural degradation of the petroleum products will also result in release of carbon dioxide into the atmosphere. Overall carbon dioxide releases will be relatively low, with negligible significance to climate change.

5.3 Capacity for Renewable Resources to Meet Needs of Land Users

The capacity for renewable resources (wildlife, vegetation, water) to continue to meet the needs of other current and potential future land users is not anticipated to be affected by the Project activities. No significant impacts to the resources are anticipated, and current land use is in any case nearly absent.

Future land use could slightly increase due to increased summer water access resulting from climate change, but the Project remediation activities will have no impact on that future land use.

5.4 Seasonal Human Activity and Effects to Heritage Values

No increases or decreases in seasonal human activity at the AECs are anticipated as a result of the Project activities, because there will be no change in accessibility resulting from the chosen remediation and risk management option. Therefore no effects are anticipated to heritage values of the project areas as a result of the Project activities. Increased water access in the summer to the AECs may occur in the future as a result of decreasing summer ice packs resulting from climate change. This is anticipated to occur whether or not the Project activities proceed.

5.5 Mitigation Measures for Cumulative Effects

No cumulative effects from the Project remediation activities are anticipated; therefore, no mitigation measures are proposed.

5.6 Residual Impacts of the Cumulative Effects

No cumulative effects from the Project remediation activities are anticipated; therefore, no residual impacts are anticipated.

5.7 Accuracy of the Assessments of Cumulative Effects

The proposed remediation works are sufficiently minor that it is highly improbable that there will be any cumulative effects resulting from the Project works.

The proposed mitigation measure of posting warning signs will likely be sufficient to prevent adverse human interactions with the AECs. The primary uncertainty is whether the signs will remain upright and undamaged indefinitely, given the severe weather conditions (strong wind, wind-blown ice particles) and the shallow soil depth above the permafrost in which to anchor the sign posts. This uncertainty will not result in any cummulative effects; it only affects the certainty of success of the signs.

6 Knowledge Deficiencies

Knowledge deficiencies include:

1. Lack of information on the rate of natural degredation of petroleum products under High Arctic conditions. Augmenting the natural levels of petroleum-degrading bacteria in a natural setting may or may not be beneficial (Government of Nunavut 2014; American Academy of Microbiology 2011).

The knowledge deficiencies do not affect the potential impacts of the recommended remediation and risk management option, although the deficiencies do make it impossible to predict the time required for degredation of the petroleum contaminants.

7 PUBLIC CONCERNS

A summary of the results of community consulation is provided in Appendix C of the RRMP. There was discussion regarding the potential for contaminants to transfer to wildlife, but in general, public concern was low. The the main concern was that no fencing be installed that would snare or block migration. No fencing is proposed in the recommended remediation and risk management plan. None of the sites are on Inuit owned land, national wildlife areas or proposed national parks. The public stated that no-one goes to the sites, so there is no need to immediately remove the contamination from the sites.

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APPENDIX 1. Receptor Identification and Assessment

Appendix 1. Guppy, Crispin. 2015. Receptor Identification and Assessment for High Arctic Site Assessments in Nunavut: Romulus, Lougheed Island, Dale Payne, Rea Point, Drake Point, and Thor Island. Prepared by Ecofor Consulting BC Ltd. for BluMetric Environmental Inc. 47 pp.

Provided as a separate document.

APPENDIX 2. Heritage Resource Overview Assessment

Appendix 2. Bennett, T. and J.P. Mooney. 2016. Heritage Resource Overview Assessment: High Arctic Assessment Project Sites Rea Point, Drake Point, Dale Payne, Lougheed Island (L1), Thor Island, and Romulus. Prepared by Ecofor Consulting BC Ltd. for BluMetric Environmental Inc. 75 pp.

Provided as a separate document.

APPENDIX 3. Project Specific Information Requirement – Part 2 Form